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RUST HAZARD AND PINE-RIBES ASSOCIATION

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In order for white pine blister rust to become established as a perennial infection center two fundamental ecological conditions must be satisfied. First, the microclimate in the immediate vicinity of the host plants must be suitable for the production, germination and establishment of the several spore forms involved in the life cycle of the disease. Secondly, the host plants must occur in sufficient numbers and sufficiently close to one another to make possible the physical transfer of the disease from one the the other. In BRC work the term, rust hazard, refers to the first of these conditions and pine-ribes association to the second.

RUST HAZARD: Involved here is a sequence of events, each part of which must occur in turn if an infection center is to become established. If the microclimatic conditions in the immediate vicinity of the ribes leaf or the pine needle are unsuitable at the required times, the sequence will be interrupted and a perennial infection on the coniferous host will not occur.

Briefly the cycle is as follows: In the spring aeciospores from distant infection centers must infect ribes leaves. During the summer a buildup of rust on the ribes must take place. (This is necessary because the initial infection generally involves too few leaves to supply an adequate source of spores for the fall ribes-pine transfer. Also, most initially infected leaves are shed before the pine-infecting sporidia are produced.) The summer buildup is accomplished by ribes-produced urediospores. In the fall teliospores and sporidia must be produced, and infection on pine needles must take place.

The general requirement for high rust hazard is a series of periods combining high humidity and low temperature, with durations ranging from a few hours to several days. The term rust hazard actually refers to the frequency with which such a series of favorable periods can be expected. A low-hazard area is one in which a complete sequence of favorable microclimatic events is unlikely. Under these circumstances a substantial concentration of ribes can be tolerated without endangering associated pines. In high hazard areas, on the other hand, close ribes suppression standards are necessary.

In Yosemite Park the high-hazard areas are restricted to stream bottoms, the edges of moist meadows, and north-facing slopes at higher elevations. Low-hazard areas are found at lower elevations and are characteristically south- or southwest-facing slopes or exposed ridge tops. Since rust hazard is closely related to general environmental conditions it is possible to identify the hazard of an area with the type of vegetative

cover it supports. Several lists of indicator plants are given on pages D-20 through D-22 of the BRC Sugar Pine Delineation Handbook. These lists are generalizations and can't be expected to fit every situation. Nevertheless, they appear suitable for application in the Yosemite area. (See also the attached material dealing with rust spread and hazard.)

PINE-RIBES ASSOCIATION: Following a successful infection on ribes the matter of pine-ribes association becomes important, for unless the disease can become established on the coniferous host during the same growing season it will die out and a new inoculation will be required. The maximum allowable distance between pine and ribes if the transfer is to take place is dependent mainly on the viability of the spores and the hazard in which the pine is growing. It varies from a few feet to several chains.

The probability of the disease being transmitted to the pine from ribes infection, however, is dependent upon the number of ribes, the number of pines, and the distance between them. These factors are referred to collectively as pine-ribes association. In BRC work the term, good association, refers to a field condition in which, apart from the micro-climatic considerations, the spread of blister rust from ribes to pine can be accomplished readily. As in the case of rust hazard, explicit standards for association are difficult to formulate and are generally unnecessary in practice. Useful guidelines are possible however. Those given below are intended only to suggest relative magnitude, and should not be used as specific rules.

Good Association

Ribes: More than 200 FLS/A
Pine : More than 10 trees/A smaller than 18 inches DBH.
Proximity: Ribes and pine occur frequently within one chain of each other.

Average Association

Determined by limits of good and poor.

Poor Association

Ribes: Less than 30 FLS/A.
Pine : Less than 3 trees/A smaller than 18 inches DBH.
Proximity: Ribes and pine infrequently occur within one chain of each other.

OVERALL RUST POTENTIAL: Both rust hazard and pine-ribes association are mutually independent factors each of which alone or in combination with the other can operate to restrict rust incidence and intensification. Thus, the overall rust potential of an area is based on an interaction of the two. This is illustrated diagrammatically below.

GENERALIZED RATING OF OVERALL BLISTER RUST POTENTIAL
BASED ON RUST HAZARD AND PINE-RIBES ASSOCIATION

Rust Hazard		Low	Medium	High
Pine-Ribes Association	Poor	LOW	LOW	LOW
	Ave.	LOW	MED	MED
	Good	LOW	MED	HIGH

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